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PATENT SPECIFICATION

674,844



Date of filing Complete Specification (under Section 16 of the Patents and Designs Acts, 1907 to 1946) April 22, 1949.

Application Date April 22, 1948.

No. 11152/48.

Application Date Feb. 11, 1949.

No. 10708/49.

(Divided out of Application No. 3774/49 [674,842]).

Complete Specification Published July 7 1952

R10a2. B10c(1v)

ERRATUM

SPECIFICATION No. 674,844

Page 3, line 35, for "674,846" read
"674,844"

THE PATENT OFFICE,
23rd February, 1954.

20 pile to assist in, or to complete, the separation of the remainder of the sheet. In machines of the kind described the nozzle conveniently consists of a foot adapted to rest on the remainder of the pile and to apply pressure thereto to prevent movement of the remaining sheets by the air blast. Such a foot is usually raised to release the pressure on the pile
25 between the separation of successive sheets. The machines may include means for forwarding the sheets in a direction transverse to the height of the pile and the arrangement may be such that the
30 sheets are fed individually or as a stream of partly overlapped or partly underlapped sheets. The aforesaid air blast may be employed to assist the forwarding of the sheets or it may affect the forwarding while the sheets are being controlled
35 by the gripping means. In the case in which a machine is arranged to operate on the uppermost sheet of the pile it is usually convenient that the edge which
40 is bent is at the rear of the pile in relation to the subsequent forwarding of the sheet. The sheets may be forwarded to a printing or other machine operating on individual sheets.

45 It is an object of the present invention to provide improved means for controlling the air blast in a machine of the kind described.

The invention provides a sheet separator
[Price 2/8]

of the pile to assist separation of the 66 sheets by a preliminary "fluffing" of the sheets and the valve may be arranged to change the air supply from one nozzle to the other in timed relation with the separation of the sheets. In one form of 70 this arrangement the "fluffing" nozzle is carried by the foot for movement therewith.

A specific example of a machine embodying the present invention is described in our co-pending Application No. 11073/48 (Serial No. 674,842). In this machine the foot operates above the rear edge of the pile and is raised from, and lowered on to, the pile in timed relation 80 with the operation of lifting and forwarding gripping devices. Depending from the heel of the foot there is a perforated tube constituting a "fluffing" nozzle, the perforations being arranged to direct 85 a series of air blasts on to the rear face of the pile. The foot is hollow and has an air inlet leading through the interior of the foot to both nozzle outlets. A flap-valve is contained within the foot and is 90 operable to divert the air supply to either one of the outlets. The machine is provided with means for effecting the raising and lowering of the foot and for operating the valve in a cycle such that the 95 rear edge of each sheet in turn is raised by a gripper by withdrawing the sheet from underneath the foot, air is then

PATENT SPECIFICATION

674,844



Date of filing Complete Specification (under Section 16 of the Patents and Designs Acts, 1907 to 1946) April 22, 1949.

Application Date April 22, 1948.

No. 11152/48.

Application Date Feb. 11, 1949.

No. 10708/49.

(Divided out of Application No. 3774/49 [674,842]).

Complete Specification Published July 2, 1952.

Index at acceptance:—Class 100(i), B10a2, B10c(1x: 5: 7: 18).

PROVISIONAL SPECIFICATION

No. 11152, A.D. 1948.

Improvements in or relating to Sheet Separating Machines

I, HEADLEY TOWNSEND BACKHOUSE, a British Subject, of "Seven Pines", Lake Road, Wentworth, Surrey, do hereby declare the nature of this invention to be as follows:—

The invention relates to machines for separating individual sheets one by one from the top or bottom of a pile and of the kind (herein referred to as the kind described) in which one edge of each sheet in turn is gripped (e.g., by a suction gripper) and bent away from the body of the pile, and a nozzle is employed to direct a short blast of air between the separated edge and the remainder of the pile to assist in, or to complete, the separation of the remainder of the sheet. In machines of the kind described the nozzle conveniently consists of a foot adapted to rest on the remainder of the pile and to apply pressure thereto to prevent movement of the remaining sheets by the air blast. Such a foot is usually raised to release the pressure on the pile between the separation of successive sheets. The machines may include means for forwarding the sheets in a direction transverse to the height of the pile and the arrangement may be such that the sheets are fed individually or as a stream of partly overlapped or partly underlapped sheets. The aforesaid air blast may be employed to assist the forwarding of the sheets or it may affect the forwarding while the sheets are being controlled by the gripping means. In the case in which a machine is arranged to operate on the uppermost sheet of the pile it is usually convenient that the edge which is bent is at the rear of the pile in relation to the subsequent forwarding of the sheet. The sheets may be forwarded to a printing or other machine operating on individual sheets.

It is an object of the present invention to provide improved means for controlling the air blast in a machine of the kind described.

The invention provides a sheet separating machine of the kind described characterised by a valve for controlling the air blast which is positioned closely adjacent to the nozzle outlet in the path of the air to the outlet. This position for the control valve reduces the time lag between the operation of the valve and the starting or stopping of the blast.

In the preferred form of the machine provided by the invention the nozzle is formed in a foot described above, and the valve is positioned in the foot.

The machine may be provided with a second nozzle directed against the face of the pile to assist separation of the sheets by a preliminary "fluffing" of the sheets and the valve may be arranged to change the air supply from one nozzle to the other in timed relation with the separation of the sheets. In one form of this arrangement the "fluffing" nozzle is carried by the foot for movement therewith.

A specific example of a machine embodying the present invention is described in our co-pending Application No. 11073/48 (Serial No. 674,842). In this machine the foot operates above the rear edge of the pile and is raised from, and lowered on to, the pile in timed relation with the operation of lifting and forwarding gripping devices. Depending from the heel of the foot there is a perforated tube constituting a "fluffing" nozzle, the perforations being arranged to direct a series of air blasts on to the rear face of the pile. The foot is hollow and has an air inlet leading through the interior of the foot to both nozzle outlets. A flap-valve is contained within the foot and is operable to divert the air supply to either one of the outlets. The machine is provided with means for effecting the raising and lowering of the foot and for operating the valve in a cycle such that the rear edge of each sheet in turn is raised by a gripper by withdrawing the sheet from underneath the foot, air is then

directed from the foot between the raised portion of the sheet and the remainder of the pile, the air is diverted to the "fluffing" nozzle, the foot is raised and then lowered on to the pile ready for separation of the next sheet.

Dated this 22nd day of April, 1948.

BOULT, WADE & TENNANT,
111 & 112, Hatton Garden,
London, E.C.1,
Chartered Patent Agents.

PROVISIONAL SPECIFICATION
No. 10708, A.D. 1949.

Improvements in or relating to Sheet Separating Machines

I, HEADLEY TOWNSEND BACKHOUSE, a British Subject, of "Sunny Ridge", West Drive, Sunningdale, Berkshire, do hereby declare the nature of this invention to be as follows:—

The invention relates to sheet separating and forwarding machines of the kind (herein referred to as the kind described) in which a suction gripper operating at or near the rear edge—considered in relation to the ultimate direction of forwarding the sheets—of the upper surface of a pile of sheets of paper, card or other material, is lowered into gripping engagement with each uppermost sheet of the pile in turn and is then, while gripping a rear portion of the sheet, raised and given a movement over the top of the pile towards the front of the pile to forward, or to control the forwarding of, the sheet to conveyor or like means (e.g. rollers gripping the front edge of the sheets) for removing the sheet from the pile, the suction gripper then releasing the sheet and returning to the initial position to engage the next sheet of the pile. Machines of this kind may be arranged to feed the sheets singly or in the form of a stream of partly overlapping or partly underlapping sheets and may be employed to feed the sheets to a printing or other machine operating on individual sheets.

In my Provisional Specification No. 11073/48 (Serial No. 674,842) I have disclosed a sheet separating and forwarding machine of the kind described having a co-operating piston and cylinder (or equivalent bellows or diaphragm and chamber) arranged for suction operation to effect the raising and lowering of the gripper, means (e.g. mechanical means) for giving oscillatory or reciprocatory movement to the gripper to effect the movements of the gripper over the top of the pile, said machine having open communication between the mouth of the suction gripper and the cylinder when the gripper is lowered to engage a sheet and the machine being arranged for operation in a cycle in which the closing of the mouth of the suction gripper by engagement with the uppermost sheet serves as a valve sealing the cylinder

from the atmosphere and enables suction preferably already applied to the cylinder, to effect relative movement between the piston and cylinder to raise the gripper with the rear portion of the sheet; the raised gripper is moved in the forwarding direction over the top of the pile as aforesaid; air is then admitted to the gripper to release the sheet while the gripper is retained in the raised position by maintenance of suction in the cylinder or by mechanical means; the raised gripper is given a backward stroke, and is then lowered to engage the next sheet by admission of air to the cylinder in the case in which suction is employed to maintain the gripper raised or in the case in which mechanical means are employed by release of the mechanical means accompanied, or anticipated, by admission of air to the cylinder.

In the preferred form of the machine described in Specification No. 11073/48 (Serial No. 674,842) the gripper is carried by the movable element of the piston and cylinder to effect the raising and lowering of the gripper and the piston and cylinder are arranged for bodily reciprocation or oscillation to effect the movements of the gripper over the pile.

It is also preferred to include in the machine as described in Specification No. 11073/48 (Serial No. 674,842) a presser foot arranged to rest, with limited pressure, on the top of the pile at the rear edge thereof during the raising of the rear edge by the gripper so that the gripper withdraws the rear edge from between the foot and the remainder of the pile. The foot may be located behind and adjacent to the gripper. Means may be included for releasing the pressure of the foot on the pile between the raising of successive sheets and the foot may be raised from the pile to a small extent. The means for releasing the pressure may be operated from a member which also effects the oscillatory or reciprocatory movements of the piston and cylinder.

It is desirable that in practice the foot shall be capable of adjustment to a small extent in the fore and aft direction of the pile to allow for variations in the position of the rear face of the pile and

also to adjust the distance to which the foot extends over the pile to suit sheets of different characteristics (e.g. thickness).

- It is an object of the present invention
- 5 to provide a simple and practical construction of a machine according to Specification No. 11073/48 (Serial No. 674,842) in which such adjustment of the position of the foot may be effected.
 - 10 The invention provides a machine as described above, and having a presser foot as described which machine has the characteristic features that a shaft extends crosswise over the pile and is
 - 15 arranged for oscillation or rotation to effect the movements of the piston and cylinder and also the raising of the foot to release the pressure, that the foot is supported for limited adjustment in the
 - 20 fore and aft direction of the pile and that the means for raising the foot comprise a lever pivoted to a support member, extending in the fore and aft direction and arranged to be given an up and down
 - 25 movement by a cam or the equivalent on the cross shaft and to engage a co-operating abutment on the foot or movable therewith, the arrangement permitting movement of the abutment in the direc-
 - 30 tion of the length of the lever on adjustment of the foot as aforesaid.
 - In the preferred form of the present invention the foot incorporates a valve as described in my Provisional Specification
 - 35 No. 11152/48 (Serial No. 674,846) and the machine includes operating means for the valve comprising a second fore and aft lever, a second cam or equivalent on the cross shaft arranged to effect up
 - 40 and down movements of the lever, a bell-crank pivoted to a guide member for the foot which member is movable with the foot and adjustment thereof and having one arm which extends fore and aft for
 - 45 engagement with the lever and operation thereby to effect partial rotation of the bell-crank and means for operating the valve on such partial rotation to control the timed emission of air from the foot
 - 50 as described in Specification No. 11152/48 (Serial No. 674,844), the arrangement permitting relative fore and after movement between the bell-crank arm and the lever on adjustment of the foot as aforesaid.
 - 55 The machine may also include a "fluffing" nozzle as described in Specification No. 11152/48 (Serial No. 674,844) and the valve may be arranged
 - 60 for operation to divert the air supply through the foot or through the "fluffing" nozzle.
 - One specific embodiment of a sheet separating and forwarding machine
 - 65 according to the invention will now

be described by way of example.

The machine forming the subject of this example comprises a frame, means for supporting and elevating a pile of sheets and means of well-known kind for 70 controlling the elevating means to maintain the top of the pile at a substantially constant height as the sheets are removed. Extending crosswise of the pile and supported at each end in the frame 75 there are two fixed parallel cross-bars of which one lies above the pile a little in front of the rear face thereof and the other lies a corresponding amount above and behind the rear face. A shaft sup- 80 ported for rotation in bearings in the frame extends crosswise and centrally between the two cross-bars.

Supported on the cross-bar and adjustable along them there are two separat- 85 ing and forwarding units. These two units are of similar construction and for the sake of simplicity only one of them will be described in detail. In use the two units are spaced apart towards the 90 side faces of the pile.

Each unit comprises an inverted rectangular box-like frame member. The longer dimension of the member extends in the fore and aft direction of the pile 95 and the member is supported along its upper front and rear edges by the cross-bars. The rotatable operating shaft passes through the sides of the frame member and carries within the member three 100 cams which are splined to the shaft. In front of the shaft there is a piston and cylinder for raising and lowering the suction gripper and for moving the gripper in the fore and aft direction as described 105 in Specification No. 11073/48 (Serial No. 674,842). This cylinder is pivotally supported on a short shaft extending between the sides of the frame member and is dependent from that shaft. A roller 110 secured to the back of the cylinder co-operates with one of the cams to effect, in combination with a return spring, an oscillatory movement of the cylinder to move the gripper forwardly and back- 115 wardly. The arrangement includes a latch for holding the gripper in the elevated position and a valve for admitting air to the cylinder as described in Specification No. 11073/48 (Serial No. 120 674,842). The parallel link construction described in that specification is omitted and is replaced by an arm extending forwardly from a shaft from which the gripper is dependent and having a roller 125 which runs along the bottom edge of the frame member or any other convenient suitably fixed part to maintain the axis of the gripper in the desired relation to the top of the pile. The frame member or 130

the equivalent part may be suitably shaped to provide this result.

Within the housing member and to the rear of the operating shaft there is a slide engaging co-operating guides on the frame member for movement in the fore and aft direction. There is a screwed spindle passing through the rear wall of the frame member and engaging a nut on the slide for effecting the movements thereof. The guides are formed on one of the longer side walls of the frame member and the slide is held against that wall by a screw passing through the wall and by a wing-nut on the outside of the frame member. This nut may be tightened to lock the slide in a desired position of adjustment. The slide has two arms which extend upwardly and downwardly from the slide respectively and which, at their free ends, are turned inwardly towards the centre of the frame member. These two inward extensions are provided with vertically aligned holes within which a compressed air tube is slidable. This tube has at its lower end a forwardly directed foot of which the toe is positioned to rest on a rear edge portion of the top of the pile. Dependent from the heel of the foot there is a short tube having perforations in its walls directed towards the rear face of the pile. Within the foot there is a flap valve arranged to divert compressed air from the tube either into the toe of the foot which is provided with a nozzle directed forwardly or into the tube at the heel of the foot which constitutes a "fluffing" nozzle. The valve is mounted on a spindle which extends outwardly through the side of the foot and has outside of the foot a short radial arm with a notch in its end face and a toggle spring arranged to retain the valve in either of its two positions. A lever is pivoted to the tube above the foot and centrally of the length of the lever. The lower end of the lever engages in the notch in the end of the operating arm for the flap valve so that a rocking movement applied to the lever moves the valve from one position to the other and *vice versa*. A bell-crank is pivoted to the upper one of the extensions from the arms of the slide and one arm of the bell-crank extends downwardly to engage the rear edge of the upper end of the lever just described. The other arm of the bell-crank extends forwardly and the arrange-

ment is that an upward movement imparted to this arm causes the other arm to engage and rock the lever in the direction to move the valve into the position in which it directs air to the toe of the foot. Return movement is effected by a spring. Rising and falling movements of the foot and the air tube cause relative movement between the lever and the arm of the bell-crank. However, as these two parts both extend in a vertical direction this does not affect the operation of the valve.

There is a lever which is pivoted to the cross shaft supporting the piston and cylinder and extending rearwardly therefrom. This lever passes over the operating shaft and has a roller engaging the second of the cams on that shaft. The rear end of the lever extends substantially horizontal and engages under an abutment on the air tube. A rising movement imparted to the lever by the cam accordingly lifts the foot from the pile. Fore and aft adjustment of the slide carrying the foot has little effect on the operation of this lever since the lever extends in the horizontal direction and the abutment is free to move along the lever.

A further lever is pivoted to a cross shaft on the frame member above the cylinder and extends rearwardly over the operating shaft. This lever also has a roller which co-operates with the third of the cams on the shaft. The rear end of the lever extends horizontally beneath the horizontal arm of the bell crank so that rising movement imparted to the lever by the cam lifts the arm of the bell-crank to move the valve as aforesaid. In this case also since the lever extends in a horizontal direction adjustment of the slide has little effect on the operation of the valve.

The several cams are shaped and positioned to effect the movements of the cylinder, the rising and falling movements of the foot and the operation of the valve in the timed relationship described in Specifications Nos. 11073/48 and 11152/48.

Dated this 22nd day of April, 1949.
BOULT, WADE & TENNANT.
111 & 112, Hatton Garden.
London, E.C.1,
Chartered Patent Agents.

COMPLETE SPECIFICATION

Improvements in or relating to Sheet Separating Machines

I, HEADLEY TOWNSEND BACKHOUSE, a British Subject, of "Sunny Ridge", West Drive, Sunningdale, Berkshire

(formerly of "Seven Pines", Lake Road, Wentworth, Surrey), do hereby declare the nature of this invention and

in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

5 The invention relates to machines for separating individual sheets one by one from the top of a pile and of the kind (herein referred to as the kind described) having a gripper (e.g. a sucker) by which
10 one edge portion of each sheet in turn is gripped and bent away from the body of the pile, and having a nozzle in the form of a foot which is arranged to rest under pressure on the body of the pile between
15 the said body and the bent edge portion of the sheet and to direct a blast of air between the bent sheet and the body of the pile to separate or assist in the separation of the remainder of the sheet while
20 the foot holds the underlying sheets and then to be removed from engagement with the pile and also having an air conduit leading to the nozzle and movable therewith. The machines may include
25 means for forwarding the sheets in a direction transverse to the height of the pile and the arrangement may be such that the sheets are fed individually or as a stream of partly overlapped or partly
30 underlapped sheets. The aforesaid air blast may be employed to assist the forwarding of the sheets or it may effect the forwarding while the sheets are being controlled by the gripping means. It is
35 usually convenient that the edge which is bent is at the rear of the pile in relation to the subsequent forwarding of the sheet. The sheets may be forwarded to a printing or other machine operating on
40 individual sheets.

It is an object of the present invention to provide improved means for controlling the air blast in a machine of the kind described.

45 The invention provides a sheet separating machine of the kind described characterised by a control valve for the air supply to the nozzle which valve is located in the movable air conduit adjacent the nozzle and means for operating
50 the control valve in timed sequence with the operation of the gripper and movements of the foot such that the air is turned on after the sheet has been bent
55 as aforesaid and is turned off from the nozzle during the period the foot is removed from the pile.

The machine may be provided with a second nozzle, directed against the face
60 of the pile to assist separation of the sheets by a preliminary "fluffing" of the sheets and the valve and operating means therefor may be arranged to change the air supply from one nozzle to the other
65 in timed relation with the separation of

the sheets. In one form of this arrangement the "fluffing" nozzle is carried by the foot for movement therewith.

Two specific examples of sheet separating machines embodying the invention 70 will now be described with reference to the accompanying drawings in which:—

Figure 1 is a side view, partly in section, of one embodiment of the machine;

Figure 2 is a plan view of one of the 75 lifting and forwarding units;

Figure 3 is a part section on the line 3—3 in Figure 1;

Figure 4 is a sectional view on the line 4—4 in Figure 1;

Figure 5 is a rear view of one of the 80 lifting and forwarding units;

Figure 6 is a detail view of the operating means for the nozzle valve;

Figure 7 is a detail view on the line 85 7—7 in Figure 1;

Figure 8 is a side view, with one cover plate removed, of the second embodiment;

Figure 9 is a plan, partly broken away, 90 of one of the units employed in the machine shown in Figure 8;

Figure 10 is a sectional view of the gripper operating means shown in Figure 8; and

Figure 11 is a section on the line 11— 95 11 in Figure 10.

The machine forming the subject of the first example and shown in Figures 1 to 7 has two lifting and forwarding units 100 1 positioned in spaced relation above the rear edge 2 of the pile 3 of sheets and supported from a common bar 4 of square section extending transversely across the pile. The two units are of similar construction and for the sake of clarity the following description relates to only one of the units.

Depending from the above-mentioned square section bar 4 there is a bracket 5 110 which is adjustably clamped (by plate 6 and screws 7) to the bar 4 for sliding adjustment along the length of the bar. The depending portion of the bracket is forked and embraced within the arms 115 of the fork there is a cylinder 10 having its mouth directed downwardly and supported at its upper end by a rocker shaft 11 below and extending parallel to the square section bar 4. The shaft 11 is supported in the two arms 12 of the bracket and in operation has oscillatory movements imparted to it by means forming no part of the present invention.

The cylinder contains a piston 15 which 125 is spring-urged in the downwards direction and carries, by means of a tubular piston rod 16 guided on the lower end of the cylinder, a transverse bar 17 on which are mounted two suction grippers 18 hav- 130

ing their mouths directed downwardly towards the top of the pile. The two grippers are spaced apart in a line parallel to the rear edge of the pile. The transverse bar 17 is hollow and there is open communication through the bar 17 and the piston rod 16 between the gripper mouths and the interior of the cylinder 10 above the piston. Further, the bar 17 is rotatable in the supporting means 20 by which it is attached to the piston rod 16 to vary the angular relation between the axes of the grippers and the top of the pile. This angle may also be adjusted by rotation of the grippers in relation to the bar 17. A short arm 21 extends substantially horizontally from the bar 17 in the direction from the rear edge of the pile and there is a link 27 pivoted to the free end of this arm. The link extends upwardly between the arms of a guide fork 23 on the cylinder and makes a pivotal-sliding connection at its upper end with a pin 24 attached to the aforesaid bracket 5. The pin is in substantially the same horizontal plane as the aforesaid rocker shaft 11 and is spaced therefrom by an amount substantially equal to the length of the arm 21 on the gripper supporting bar 17. The cylinder, the arm, the link and the supporting bracket consequently constitute a parallel link system, as described above, and maintain the axes of the grippers at a substantially constant angle to the plane of the pile during the oscillatory movement of the cylinder derived from the rocker shaft. A spring 22 urges the gripper supporting bar 17 for rotation up to a stop in a direction to hold the link at the upper limit of its sliding movement on the pin 24. The anchor 22a of the spring engages the arm 21 to constitute the stop.

The cylinder carries an external latch 30 which is pivoted to the cylinder at the rear thereof. The latch is in the form of an upwardly extending lever pivoted to the cylinder for rotation about a horizontal axis 31 at approximately the centre in the length of the lever. At its lower end the lever has a lateral abutment 32 forming the latch which is arranged to engage under the lower face of the piston when the piston is at the upper limit of its travel in the cylinder (i.e. as shown in Figure 1). A spring urges the lever into the latching position. The upper end of the latch is arranged to engage, as later described, with an adjustable stop screw 33 secured to the bracket 5 which engagement effects the release of the latch from the piston.

The rocker shaft 11 supporting the cylinder is hollow and has a port com-

municating in a manner like that shown in Figure 10, with the upper end of the cylinder. The cylinder has a further port 41 in its side leading to the atmosphere and closed by an external flap valve 42 arranged to co-operate with a stop pin 43 on the bracket 5.

The operation of the mechanism as so far described is as follows: Starting from the position in the cycle when the grippers have been lowered on to the top of the pile the engagement of the gripper mouths with the uppermost sheet serves to seal the mouths and consequently the open communication to the cylinder through the mouths. Suction which is continuously applied to the cylinder through the hollow rocker shaft and the connecting port between the shaft and the cylinder then builds up in the cylinder and causes the piston to rise carrying with it the grippers and the rear portion of the uppermost sheet adhering thereto. At the upper limit of the movement of the piston the latch 30 engages underneath the piston to retain it in the uppermost position. The cylinder then oscillates in the forwards direction moving the grippers and the rear portion of the sheet with it, while at the same time the link system maintains the axes of the grippers at a substantially constant angle to the surface of the pile. Immediately before the cylinder reaches the end of its forward movement the flap valve carried by the cylinder is engaged by the stop pin 43 on the bracket which opens the valve and admits air to the cylinder. The air admission port is of substantial size and admits sufficient air substantially to destroy the partial vacuum built up in the cylinder and thereby releases the hold of the grippers on the sheet enabling the sheet to be withdrawn by rollers or other forwarding means operating at the front edge of the pile. The destruction of the partial vacuum in the cylinder also releases the piston but this is, as already explained, retained in its uppermost position by the latch. The direction of movement of the cylinder is then reversed and the piston is swung back to its initial position. There is a short "dwell" intermediate in the backward stroke of the cylinder for the purpose later described. Just before the end of the rearward movement of the cylinder the upper end of the latch lever comes into contact with the stop screw 33 so that continued movement of the cylinder swings the latch lever 30 about its pivot and disengages the latch from the piston allowing the piston to fall and thereby to bring the grippers into engagement with a new sheet on top of the pile. The flap valve

closes during the first part of the rearward movement of the cylinder but the admission of air to the cylinder through the gripper mouths prevents suction being built up in the cylinder until the mouths engage the new sheet. The engagement of the grippers with the new sheet initiates the next cycle of operations.

10 Extending rearwardly from the cylinder towards the upper end thereof there is an arm 50 bearing at its end a roller 51 having a pivotal-sliding engagement in a horizontal slot 52 formed in a cross-head 53 which is supported for vertical sliding movement on a rod 54 forming one of two fixed rods 54, 55 depending vertically from the plate 6 attached to the aforesaid bracket 5. The lower ends 20 56 of these rods serve as gauges to engage the rear face of the pile and thereby to locate the mechanism in relation to the pile. The oscillatory movements of the cylinder impart through the arm 50 vertical movements to the cross-head 53. 25 The slot in the cross-head 53 is of sufficient length to permit adjustment of the cylinder towards and away from the rear edge of the pile and the supporting plate 30 6 has a slot 57 arranged to provide such adjustment in relation to the square rod 4 to which the bracket 5 is clamped. Adjustments of this nature may be employed to adapt the mechanism to 35 sheets of different characteristics (e.g., thickness and stiffness).

Behind the vertical rods 54, 55 above described there is a square tube 60 which is also vertically dependent from the plate 40 6. This tube 60 is embraced by a fork 61 projecting from the rear of the cross-head 53 behind its supporting rod 54. A hollow foot 62 is slidable on the tube 60 and extends in the forwards direction to 45 engage the top of the pile. A compression spring 65 surrounding a guide rod 66 dependent from the plate 6 and received within a vertical socket in the foot is, in this example, employed to develop clamping pressure of the foot on the pile. This 50 spring may be omitted in cases where sufficient pressure is obtained by the weight of the foot, or other means.

Pivotaly supported from one of the 55 arms of the fork 61 of the cross-head 53 there is a bell-crank latch lever 70 of which one leg extends downwardly from the pivot and is shaped at 71 to constitute a latch to engage with a catch-piece 72 on the foot. The other leg 73 of the bell-crank extends rearwardly from the pivot to engage with an adjustable stop 76 on the support plate 6. A spring 75 urges the downwardly projecting leg of the 65 bell-crank 70 in the rearward direction to

engage with the catch-piece 72 on the foot.

The foot carries a blower tube 80 which depends from the lower face of the foot behind the rear face of the pile and has 70 nozzle outlets 81 directed towards the pile. A throughway 82 in the foot connects the nozzle outlets with the interior of the hollow foot and thence to the throughway of the aforesaid square guide 75 tube 60. A flap valve 83 contained within the foot and rotatable about a horizontal axis 84 is, arranged to divert compressed air admitted to the guide tube 60 either to the nozzle outlets 81 depending from 80 the rear of the foot—which constitute the "fluffing nozzle"—or to a nozzle outlet 86 formed in the foot itself. The supporting spindle for the flap valve 83 extends outwardly from the foot and has on one 85 end a short lever arm 88 for re-setting the valve. On the other end it has a forwardly directed catch 89. A spring and plunger 90 pressing against the rear of the catch 89 urges the valve into the position in which the air is directed to the 90 nozzle in the foot. A vertically extending lever 91 pivoted to the foot serves as a latch engaging the catch 89 to retain the flap valve, against the spring plunger 90, 95 in the position in which the air is diverted to the "fluffing nozzle". The latch lever 91 is arranged to release the catch 89 on engagement by the lever 70 as later described. Pivoted from the second arm of 100 the cross-head form 61 there is a further bell-crank 95 having a downwardly extending leg 96 and a rearwardly extending leg 97. The downwardly extending leg 96 co-operates with a further lever 98 pivoted to the foot 62 of 105 which the lower end engages the vertically extending re-set arm 88 on the valve spindle. The hook-like stop 74 depending from the plate 6 is arranged to engage 110 the underside of the rearwardly projecting leg 97 of the bell-crank 95 towards the lower limit of the sliding movement of the cross-head.

The operation of the foot and associated 115 parts will now be described. When the grippers are lowered into gripping engagement with the top of the pile the foot is resting with light pressure on the uppermost sheet and remains in that position during the raising of the rear edge 120 of the sheet by the grippers which withdraw this portion of the sheet from between the foot and the remainder of the pile. The cylinder then makes a slight rearward movement (i.e. to the right as 125 viewed in Figure 1) which lifts the cross-head, by engagement of the arm 50 on the cylinder with the slot 52 in the cross-head 53, and by engagement with its 130

associated stop 76 of the horizontal arm 73 of the bell-crank lever 70 on the cross-head (i.e. the bell-crank lever 70 which has the latch 71 for engagement with the catch 72 on the foot) causes the lower arm of the bell-crank 70 to move forwardly into engagement with the latch lever 91 holding the flap valve in the foot, thereby releasing the valve which is rotated by the spring to divert the air into the foot which directs a blast of air between the lifted rear edge of the sheet and the remainder of the pile. The cylinder now reverses its movement (i.e. it moves forwardly) and the lifted sheet is moved in the forward direction by the action of the air blast and by the suction grippers. This forward movement of the cylinder causes the cross-head to be lowered and towards the end of the downward movement of the cross-head the latch 71 engages under the catch 72 of the foot. In addition, and immediately before the limit of the downward movement of the cross-head is reached, the second bell-crank lever 95 comes into contact with the hook-like stop 74 so that the final movement of the cross-head rotates the bell-crank which through the associated lever 98 rotates the re-set arm 88 of the flap valve to restore the valve to its initial position where it is held by the latch 91 and in which the air is diverted to the "fluffing" nozzles. On the return, rearward, movement of the cylinder the cross-head rises and the foot is raised by its latching engagement with the bell-crank lever 70 until arm 73 of the bell-crank lever comes into abutment with its stop 76 which then releases the foot to fall back on to the pile. The above-mentioned "dwell" in the movements of the cylinder now occurs to allow the foot time to seat itself on the pile. Back movement of the cylinder is then continued and the piston is released by the catch and lowered to engage the grippers with the pile. In addition the further movement of the lever 70 due to the continued engagement of arm 73 with stop 76 causes the release of the flap valve as previously described.

Briefly summarising the cycle of operations of the apparatus the grippers are first lowered on to the uppermost sheet, the engagement of the grippers with the sheet seals the air inlet to the cylinder causing the grippers to be lifted and thereby to withdraw the sheet from underneath the foot, an air blast is directed from the foot between the lifted sheet and the pile, and the grippers move forwardly with the sheet. The sheet is released by admission of air to the cylinder, the cylinder returns while the piston

is held in the elevated position, the foot is raised, the air is diverted to the "fluffing" nozzles, the foot is lowered on to the pile and the piston is then released to lower the grippers ready to commence a new cycle.

The machine forming the subject of the second example is shown in Figures 8 to 11 and comprises a frame, means for supporting and elevating a pile of sheets and means of well-known kind for controlling the elevating means to maintain the top of the pile at a substantially constant height as the sheets are removed. Extending crosswise of the pile and supported at each end in the frame there are two fixed parallel cross-bars 100 of which one lies above the pile 101 a little in front of the rear face thereof and the other lies a corresponding amount above and behind the rear face. A shaft 102 supported for rotation in bearings in the frame extends crosswise and centrally between the two cross-bars.

Supported on the cross-bars and adjustable along them there are two separating and forwarding units 103. These two units are of similar construction and for the sake of simplicity only one of them will be described in detail. In use the two units are spaced apart towards the side faces of the pile.

Each unit comprises an inverted rectangular box-like frame member 104. The longer dimension of the member extends in the fore and aft direction of the pile and the member is supported along its upper front and rear edges by the cross-bars. The rotatable operating shafts 102 passes through the sides of the frame member and carries within the member three cams 106, 107, 108 which are splined to the shaft. In front of the shaft there is a piston 109 and cylinder 110 for raising and lowering the suction gripper 111 and for moving the gripper in the fore and aft direction as described in the previous example. This cylinder is pivotally supported on a short shaft 112 extending between the sides of the frame member and is dependent from that shaft. A roller 115 secured to the back of the cylinder co-operates with the cam 106 to effect, in combination with a return spring 116, an oscillatory movement of the cylinder to move the grippers forwardly and backwardly. The arrangement includes a latch 118 for holding the gripper in the elevated position and valve 119 for admitting air to the cylinder as described in the previous example. The parallel link construction described in the above example is omitted and is replaced by an arm 120 extending forwardly from a shaft 121 from which the

gripper is dependent and having a roller 122 which runs along the bottom edge 123 of the frame member or any other convenient suitably fixed part to maintain the axis of the gripper in the desired relation to the top of the pile. The frame member or the equivalent part may be suitably shaped to provide this result.

Within the housing member 104 and to the rear of the operating shaft 102 there is a slide 130 engaging co-operating guides 131 on the frame member for movement in the fore and aft direction. There is a screwed spindle 132 passing through the rear wall of the frame member and engaging a nut 133 on the slide for effecting the movements thereof. The guides are formed on one of the longer side walls of the frame member and the slide is held against that wall by a screw 134 passing through the wall and by a wing-nut 135 on the outside of the frame member. This nut may be tightened to lock the slide in a desired position of adjustment. The slide 130 has two arms 140, 141 which extend upwardly and downwardly from the slide respectively and which, at their free ends, 142, 143 are turned inwardly towards the centre of the frame member. These two inward extensions are provided with vertically aligned holes within which a compressed air tube 144 is slidable. This tube has at its lower end a forwardly directed foot 145 of which the toe is positioned to rest on a rear edge portion of the top of the pile 101. Dependent from the heel of the foot there is a short tube 150 having perforations 151 in its walls directed towards the rear face of the pile. Within the foot there is a flap valve (not shown) arranged to divert compressed air from the tube 144 either into the toe of the foot which is provided with a nozzle 152 directed forwardly or into the tube 150 at the heel of the foot which constitutes a "fluffing" nozzle. The valve is mounted on a spindle 153 which extends outwardly through the side of the foot and has outside of the foot a short radial arm 154 with a notch 155 in its end face and a toggle spring 156 arranged to retain the valve in either of its two positions. A lever 160 is pivoted to the tube above the foot and centrally of the length of the lever. The lower end of the lever 160 engages in the notch 155 in the end of the operating arm for the flap valve so that a rocking movement applied to the lever moves the valve from one position to the other and *vice versa*. A bell-crank 161 is pivoted to the upper extension 140 from the arms of the slide and one arm 162 of the bell-crank extends downwardly to engage the rear edge of the upper end of the lever 160. The other arm 163 of the bell-crank extends forward and the arrangement is that an upward movement imparted to this arm causes the other arm to engage and rock the lever 160 in the direction to move the valve into the position in which it directs air to the toe of the foot. Return movement is effected by a spring 165. Rising and falling movements of the foot and the air tube cause relative movement between the lever 160 and the arm 162 of the bell-crank. However, as these two parts both extend in a vertical direction this does not affect the operation of the valve.

There is a lever 170 which is pivoted to the cross shaft 112 supporting the piston and cylinder and extending rearwardly therefrom. This lever passes over the operating shaft 102 and has a roller 171 engaging the cam 108 on that shaft. The rear end 172 of the lever extends substantially horizontal and engages under an abutment 173 on the air tube. A rising movement imparted to the lever by the cam accordingly lifts the foot from the pile. Fore and aft adjustment of the slide carrying the foot has little effect on the operation of this lever since the lever extends in the horizontal direction and the abutment is free to move along the lever.

A further lever 180 is pivoted to a cross shaft 181 on the frame member above the cylinder and extends rearwardly over the operating shaft. This lever also has a roller 182 which co-operates with the cam 107 on the shaft 102. The rear end of the lever extends horizontally beneath the horizontal arm 163 of the bell-crank 161 so that rising movement imparted to the lever by the cam lifts the arm of the bell-crank to move the valve as aforesaid. In this case also since the lever extends in a horizontal direction adjustment of the slide has little effect on the operation of the valve.

The several cams are shaped and positioned to effect the movements of the cylinder, the rising and falling movements of the foot and the operation of the valve in the timed relationship described in the previous example.

Certain features of the above-described machines form the subject of the claims of my Specifications Nos. 11073/48 and 11098/48 (Serial Nos. 674,842 and 674,843).

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A machine of the kind described characterised by a control valve for the air

- supply to the nozzle which valve is located in the movable air conduit adjacent the nozzle and means for operating the control valve in timed sequence with the operation of the gripper and movements of the foot such that air is turned on after the sheet has been bent as aforesaid and is turned off from the nozzle during the period the foot is removed from the pile.
- 10 2. A machine as claimed in Claim 1 which is provided with a second nozzle, directed against the face of the pile to assist separation of the sheets by a preliminary "fluffing" of the sheets and in
- 15 which the valve and operating means therefor are arranged to change the air supply from one nozzle to the other in timed relation with the separation of the sheets.
- 20 3. A machine as claimed in Claim 1 or Claim 2 in which the operating means for the foot comprise a shaft which extends cross-wise over the pile and is arranged for oscillation or rotation to effect raising
- of the foot to release the pressure on the pile between the separation of successive sheets and which machine includes a lever extending in the fore and aft direction of the pile, a cam on the cross-shaft arranged to effect up and down oscillation of the lever, a bell-crank pivoted to a guide member for the foot and having one arm which extends fore and aft for engagement with the lever and operation thereby to effect partial rotation of the bell-crank, and means for operating the valve on such partial rotation to control the timed emission of air from the foot, the arrangement permitting relative fore and aft movement between the bell-crank arm and the lever on adjustment of the foot in the fore and aft direction.
- Dated this 22nd day of April, 1949.
BOULT WADE & TENNANT,
111/112, Hatton Garden,
London, E.C.1,
Chartered Patent Agents.

Leamington
Published at The Pat.

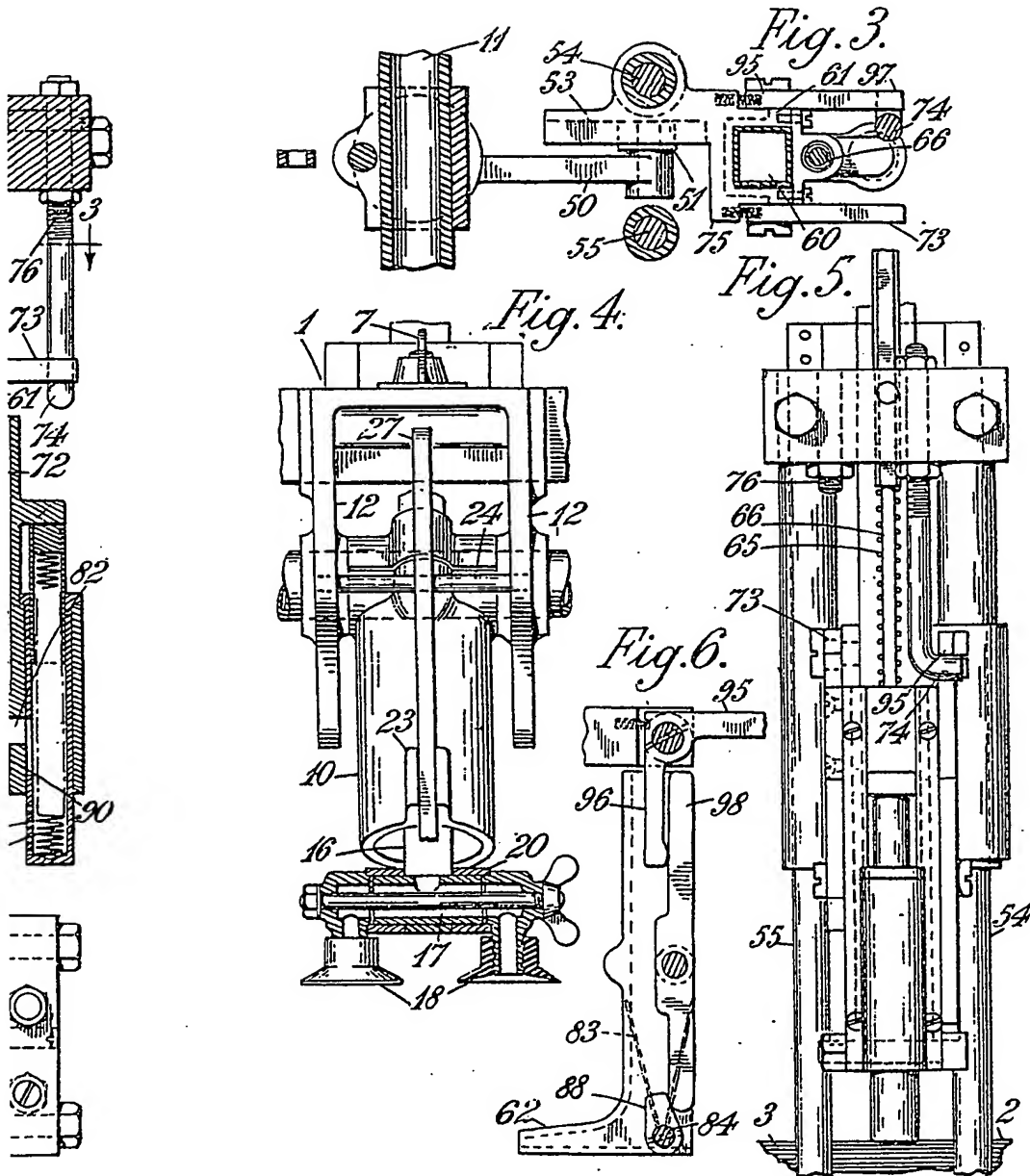
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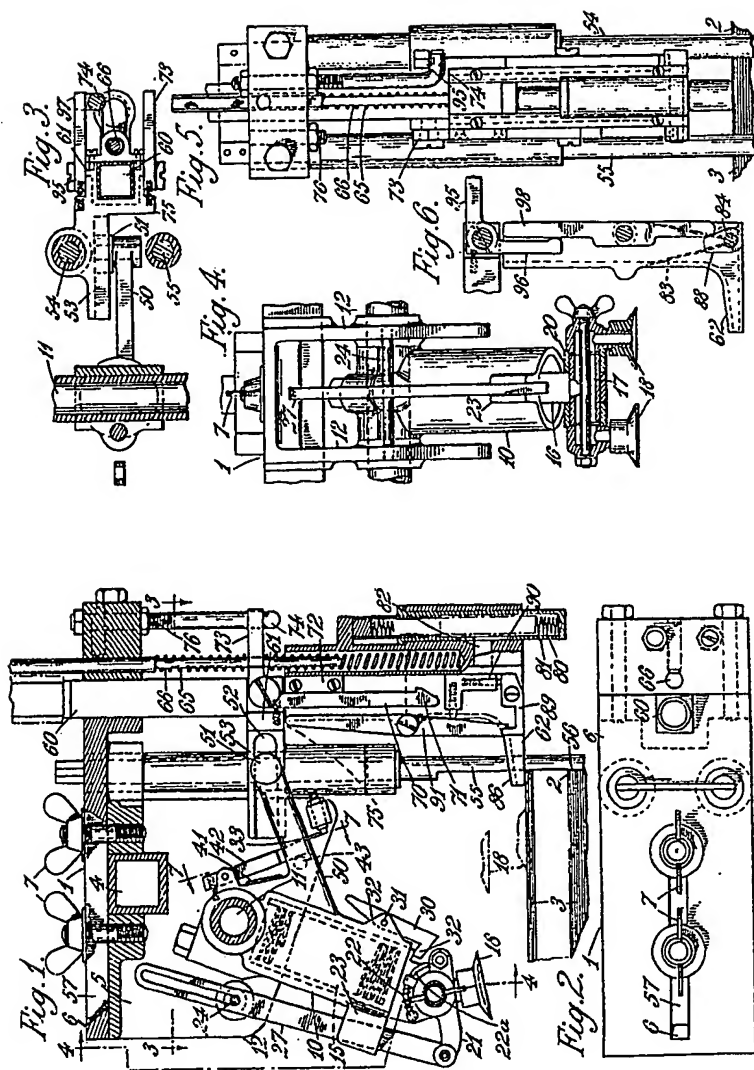
674,844 COMPLETE SPECIFICATION

5 SHEETS

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SHEETS 1 & 2





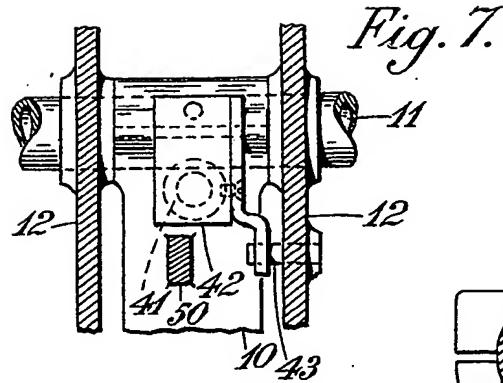


Fig. 10.

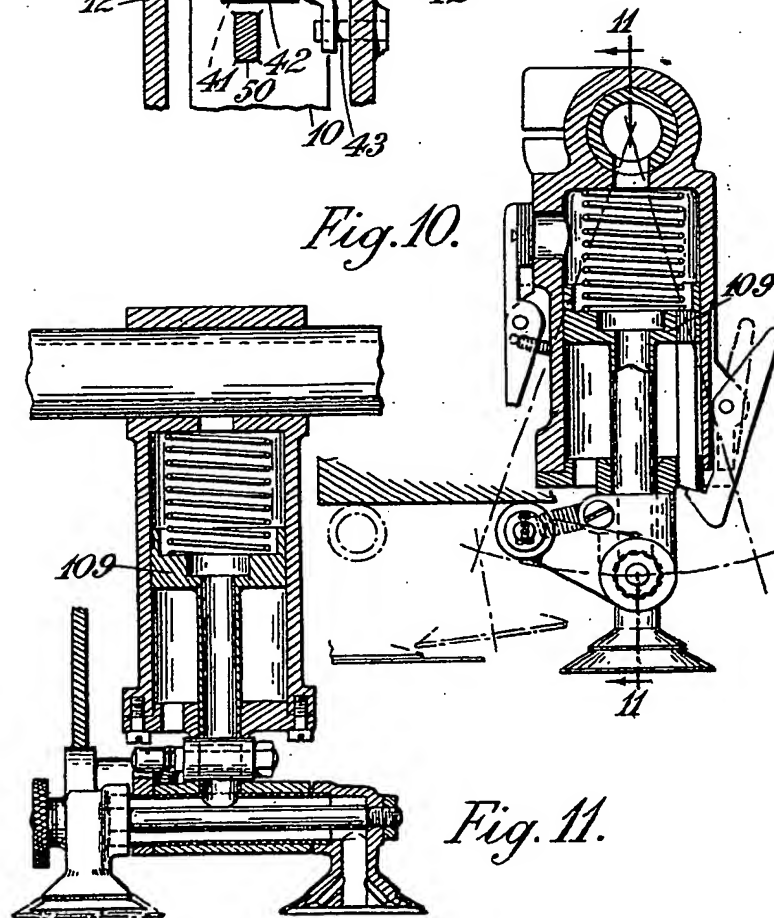


Fig. 11.

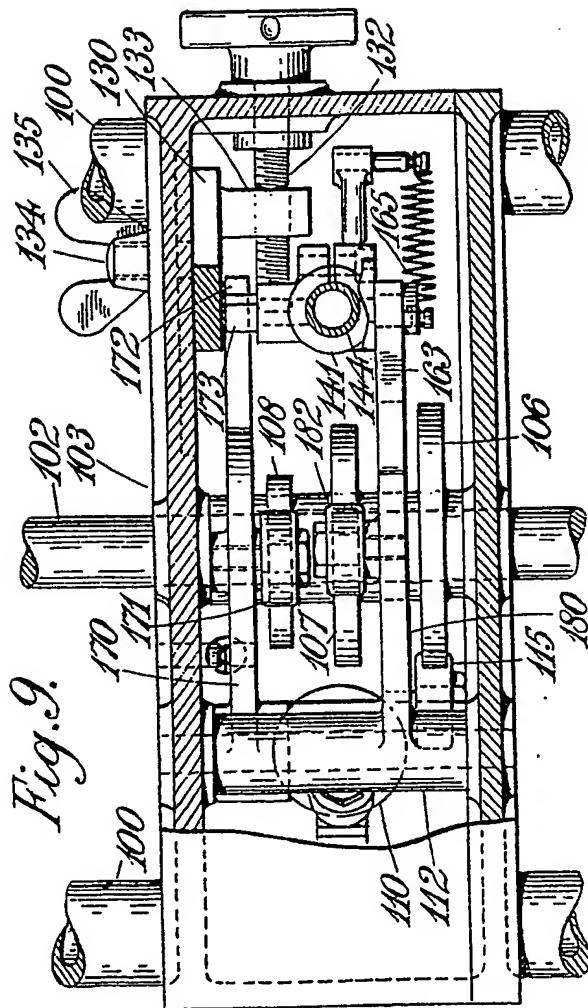


Fig. 9.

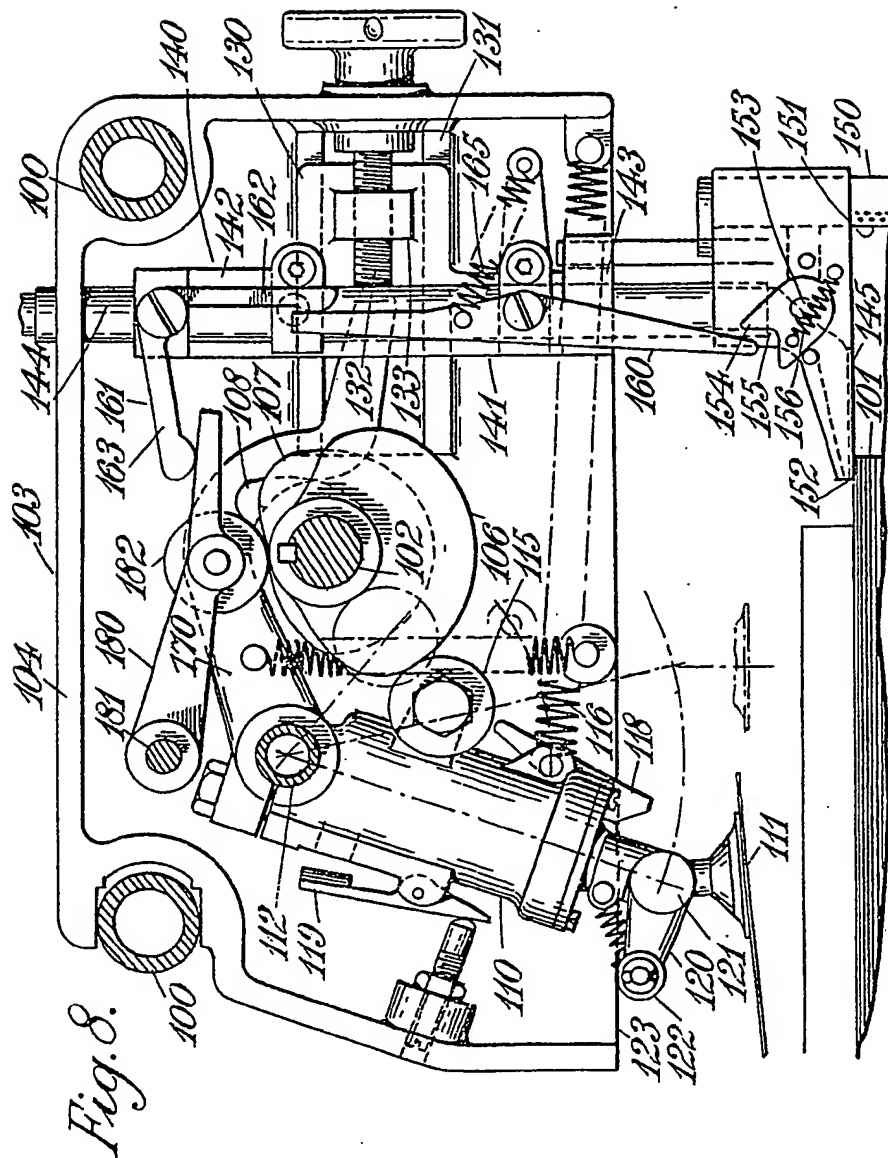
104 103 144 100

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5 SHEETS

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SHEETS 4 & 5



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